New Hampshire Volunteer River Assessment Program

EXETER RIVER

2000

Water Quality Monitoring Report

February 2003

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STATE OF NEW HAMPSHIRE

Volunteer River Assessment Program

2000

EXETER RIVER

Water Quality Report

STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
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1. VOLUNTEER RIVER ASSESSMENT PROGRAM OVERVIEW

VRAP ("vee-rap") supports watershed organizations in their efforts to monitor river water quality. The primary focus of VRAP is to provide volunteers with river monitoring guidelines, equipment loans, and technical training. DES also incorporates applicable volunteer monitoring results into its evaluation of New Hampshire surface waters. Annual reports for each VRAP river include a summary of monitoring results and recommendations for future water quality sampling. VRAP aims to foster public understanding and stewardship of river systems and to increase available water quality information about New Hampshire rivers and streams.

VRAP loans and maintains water monitoring kits that include meters and supplies for on-site measurement of five basic water quality parameters: water temperature, dissolved oxygen, pH, specific conductance (conductivity), and turbidity. The investigation of these and additional parameters such as nutrients, metals, and bacteria is conducted by state water quality personnel and may be augmented by volunteer sampling. Sampling additional parameters comes with the cost of analysis, which can be covered by an assortment of fundraising activities such as association membership fees, special events, and in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. Water quality results are also used to determine if a river is meeting surface water quality standards. Volunteer monitoring results meeting DES's Quality Assurance and Quality Control (QA/QC) requirements supplement the efforts of DES to assess the condition of New Hampshire surface waters. The New Hampshire Surface Water Quality Regulations are available through the DES Public Information Center at www.des.state.nh.us/wmb/Env-Ws1700.pdf or (603) 271-1975.

VRAP typically recommends sampling every other week during the summer, and citizen monitoring groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions. Each year volunteers arrange a sampling schedule and design in cooperation with the VRAP Coordinator. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency.

Each VRAP volunteer must attend an annual training session to receive a demonstration of monitoring protocols and sampling techniques. Training sessions are an opportunity for volunteers to come together and receive an updated version of monitoring techniques. Training sessions are typically conducted outdoors near surface waters for an interactive demonstration. During the training volunteers have a chance to practice using the VRAP

equipment and may also receive instruction in the collection of samples for laboratory analysis. Training is accomplished in approximately three hours, after which volunteers are certified in the care, calibration, and use of the VRAP equipment.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. VRAP aims to visit volunteers during scheduled sampling events to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. Volunteers forward water quality results to the VRAP Coordinator for incorporation into an annual report and state water quality assessment activities.

Applicable volunteer data are input to a water quality database, and considered (along with other reliable sources of data) during periodic DES water quality assessments. Assessment results and the methodology used to assess surface waters are published by DES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act.

More than fifty VRAP volunteers sampled five rivers regularly during the year 2000. VRAP 2000 rivers include the Lamprey, Exeter, Cocheco, Sugar, and Baker Rivers, as well as preliminary sampling on several additional rivers and streams. These accomplishments were made possible by the hard work and dedication of citizen volunteers and many additional people who helped to plan, support, and carry out these monitoring efforts.

2. PROJECT SUMMARY

The Exeter River VRAP team, consisting of Don and Helen Clement and John Henson, concluded the third year of water monitoring on the Exeter River. The goal of this effort is to begin monitoring and recording key information about all Exeter's watershed and to set baseline water quality measurements that can be utilized currently and in the future.

Several canoe trips to observe some of the less accessible portions of the river were also undertaken. In addition the team expanded the testing site to the Little River, a major tributary to the Exeter. Next year, with the purchase of water testing equipment by the Exeter Conservation Commission, the team hopes to expand the testing to several other brooks and streams that flow into the Exeter river. In this time of fast paced growth, maintaining the health of the Exeter River watershed is critical.

3. RESULTS, DISCUSSION, AND RECOMMENDATIONS

This section includes a description of the Exeter River VRAP 2000 monitoring locations and results, a discussion of the results in comparison with New Hampshire water quality standards, and recommendations for future sampling and watershed investigations. The VRAP monitoring locations, "stations", are discussed from upstream to downstream (see Appendix A for a list of stations). Results are presented in graphs and text prepared by

VRAP, and tables including all monitoring results from each station are located in Appendix B. The discussion of the results includes recommendations for future sampling and investigations that will contribute to the assessment of water quality conditions.

The water quality information collected at each station is summarized in a table that provides the reader with an overview of the monitoring activities and results. The table can be used as a quick reference for the reader; results not meeting state water quality criteria do not necessarily indicate a violation of water quality standards. The summary table indicates: (1) the number and type of samples collected, (2) the number of samples collected according to quality assurance and quality control requirements, (3) the number of samples not meeting state water quality criteria, (4) the range of the measurements, and (5) abbreviated water quality standards.

The presentation and discussion of the volunteer results focuses primarily on three parameters: DO, temperature, pH, and bacteria. These parameters are the core of the VRAP monitoring system, and have relatively straightforward standards that lend themselves to the assessment of individual results. These results can contribute directly to the determination of fishable and swimmable river and stream conditions, which is often a primary volunteer monitoring goal. This section includes graphs of dissolved oxygen (DO) concentrations with water temperature, and *E. coli* bacteria results (if collected). Please see Appendix C for descriptions of the water quality parameters analyzed under VRAP during 2000 and the associated New Hampshire surface water quality standards (SWQS) for Class B waters.

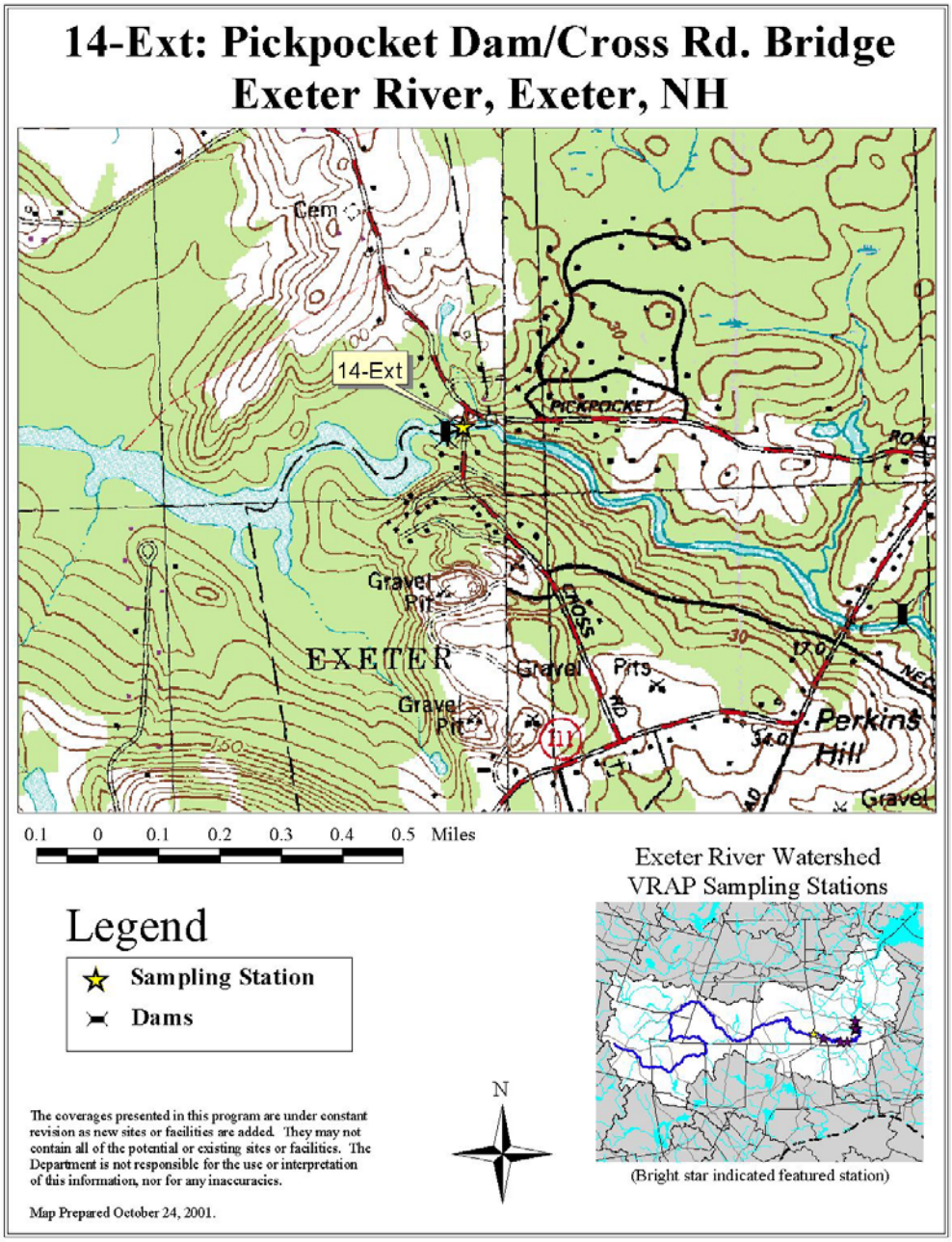
The reader should note that discussion is limited to those parameters at each station that do not meet state criteria. For example, since DO is the only parameter at 09-Ext that exceeded state criteria, only DO will be discussed in detail. However, recommendations are not limited to parameters with results that fall outside state criteria.

VRAP aims to provide a mechanism for citizens to contribute to the ongoing process of surface water quality assessment. Recommendations for future monitoring activities and watershed investigations are included in this report following the results and discussion. Also included are recommendations for improvements in sampling techniques to encourage volunteers to adhere to quality assurance and control measures.

Volunteers are encouraged to sample their rivers and streams on a long-term basis. Much of the information volunteers collect profiles river and stream locations for the first time. Several (five to ten) years of good quality measurements will be needed to begin to decipher water quality trends and the status of rivers and streams relative to the New Hampshire surface water quality standards. Water quality data from the stretch of river sampled by volunteers are presented in graphs in Appendix D. These graphs are included in the report to show how water quality conditions change from upstream to downstream. The current report format will describe water quality conditions on a station-by-station basis.

All results generated by the Exeter River VRAP 2000 were collected using the VRAP Field Datasheet and Field Sampling Protocols, 2000 (see Appendix E).

3.1. 14-Ext: Pickpocket Dam/Cross Road Bridge, Exeter, NH



3.1.1. Results and Discussion

Nine measurements for dissolved oxygen and turbidity, seven for pH, and eight for conductivity were made in the field using handheld meters. All measurements and samples met the QA/QC requirements, but pH data indicate that the Exeter River at 14-Ext in the year 2000 did not meet Class B Water Quality Standards for this parameter (see Table 1).

Table 1. Monitoring Summary: 14-Ext. VRAP, Year 2000.

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standard*
DO (mg/L)	9	9	0	8.15 - 9.44	**>5**
DO (% sat.)	9	9	0	89.9 - 101.1	**>75**
pH (std. Units)	7	7	1	6.4 - 7.1	**6.5-8.0**
Turbidity (NTUs)	9	9	0	2.5 - 4.5	**<10 NTU above background**
Conductivity (μmho/cm)	8	8	0	139 - 166.7	**NA**

3.1.1.1. Dissolved Oxygen

Dissolved oxygen in the river at 14-Ext remained well above the minimum required concentration of 5 mg/L (see Figure 1). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day.

The samples collected by volunteers approximately reflect the lowest dissolved oxygen levels reached in the river at this location. Rivers and streams with vegetation experience daily fluctuations in DO due to photosynthesis (oxygen production during daylight) and respiration (oxygen use, carbon dioxide production). The lowest DO levels are reached during the early morning hours, when photosynthesis has not been occurring since sundown, but respiration and the consumption of oxygen has continued throughout the night. Peak DO levels are reached during the late afternoon. These samples were all collected between 7:30 and 8:00am.

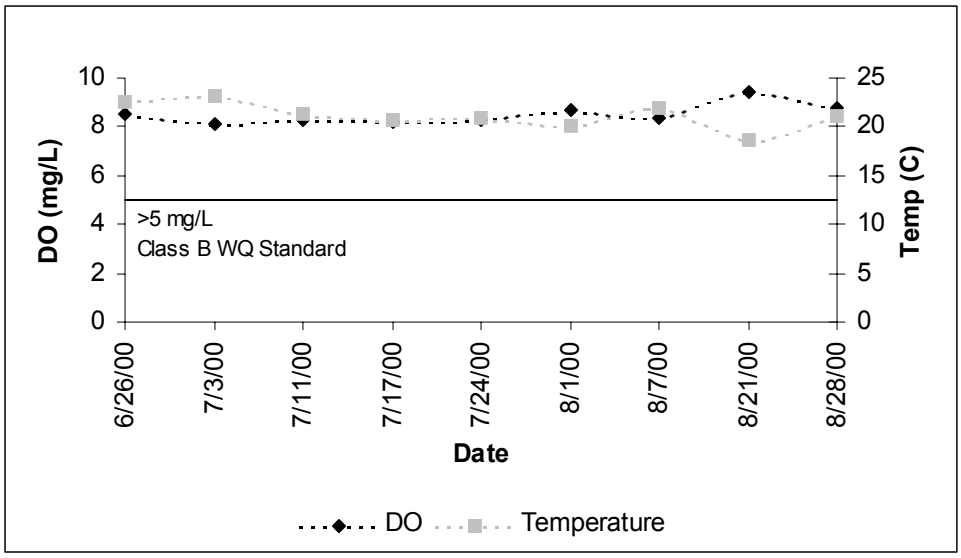


Figure 1. Dissolved Oxygen (DO) Concentration vs. Temperature. Exeter River at 14-Ext, Pickpocket Dam/Cross Road Bridge, Exeter, NH. VRAP, Year 2000.

3.1.1.2. pH

The pH at this location, ranging from 6.4 to 7.1, was measured below the state standard range on one of the seven monitoring dates. Station conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands, then the low pH measurements are not considered a violation of water quality standards. In this case, additional information about factors influencing pH levels is needed.

3.1.2. Recommendations

- *Baseline Monitoring*: VRAP volunteers are making water quality data available across the State of New Hampshire, in some locations for the very first time. Prior to volunteer monitoring efforts, very little information about the river in this location was available. The volunteer sampling that has taken place has helped create the recommendations in this report. Volunteers are encouraged to continue baseline monitoring activities at this location to establish a record of water quality during all weather conditions, and to ensure that this area of the river remains within standards. The more information in the baseline data set, the more will be known about the river's water quality dynamics, or variations. Volunteer monitoring augments the data collection and river management efforts of DES, as well as local decision makers.

Special attention should be paid to weather conditions previous to and during the time of sampling. For data interpretation purposes, it is extremely important that weather conditions are provided to VRAP along with the water quality data. Without a record of weather conditions, it is extremely difficult to speculate on the cause of water quality conditions.

- *Dissolved Oxygen*: Keeping a record of DO will help to document variations in the river, and provide early detection of changes in the river. Prior to volunteer monitoring efforts, little information about the river at this location was available. It is important to note that good DO levels at this location help to maintain DO levels downstream. Although the river appears to be meeting the minimum instantaneous DO concentration (5 mg/L) at this location, baseline monitoring should continue with special attention to the time of sampling.

  To determine if oxygen saturation in the river at this location falls below water quality standards, monitoring data must represent worst and best-case scenarios of DO saturation. Volunteers working with DES can provide the watershed community with the necessary morning **and** afternoon data points. Arrangements for sampling oxygen saturation in the river more than once per day can be made through VRAP and the Ambient River Monitoring Program.

- *pH*: Volunteers can help determine if this location in the river meets the pH standard by providing DES with additional water quality data and information about the influences affecting water quality at this station. This process will not be completed in the short term, because of the variability of water quality and the amount of research required. Volunteers may choose to plan one of the following three phases each year, until a determination can be made in cooperation with DES:

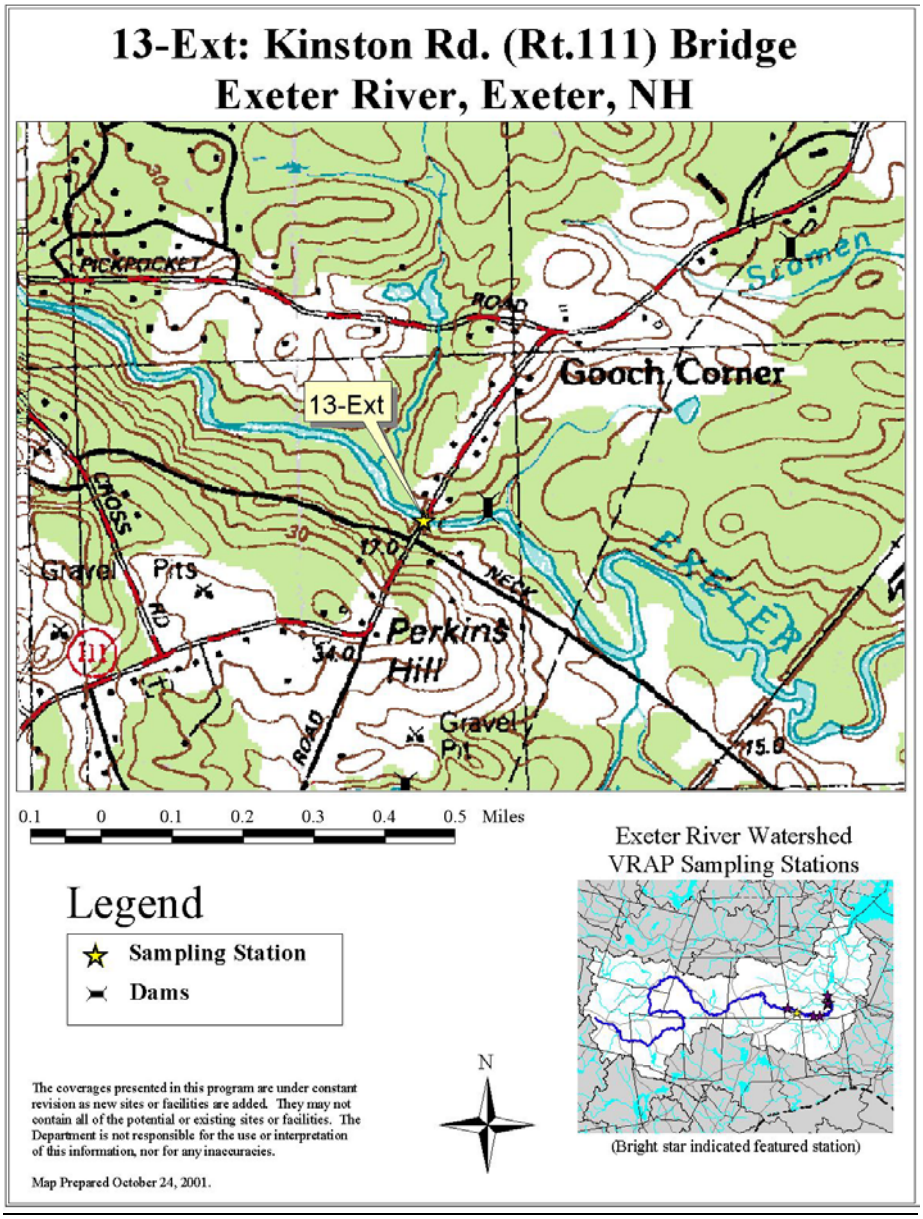
  Phase I:
  As a first response to low pH measurements, volunteers can investigate the immediate drainage area to determine if the river is receiving wetland flow. Are there wetlands in the area that are potentially influencing water quality at this location? A simple way to answer this question would be to walk around the area looking for wetlands influencing the station. Topographic and GIS (Geographic Information Systems) maps may also provide useful information.

  Phase II:
  If wetland drainage is present, the next step to determining the influence is to sample upstream from the wetland, if possible. If volunteers sample upstream from a wetland and discover that pH is within the standard range, then it is likely that the wetland itself is contributing to low pH in the river. If the pH remains low upstream from the influencing wetland, then it is possible that there is another source of acidity even further

upstream. Continue to investigate upstream until all possible influences have been documented.

Phase III: If volunteers have determined that wetland drainage is influencing a monitoring station, then further information about the nature of that influence must be gathered. Is the wetland in a natural state or impacted by surrounding areas? DES will work with volunteers to make this determination.

3.2. 13-Ext: Kingston Road Bridge, Exeter, NH



3.2.1. Results and Discussion

Nine measurements for dissolved oxygen concentration, turbidity, and conductivity, were made, while eight for DO saturation, and seven for pH were made in the field using handheld meters. All measurements and samples met the QA/QC requirements, but pH data indicate that the Exeter River at 14-Ext in the year 2000 did not meet Class B Water Quality Standards for this parameter (see Table 2).

Table 2. Monitoring Summary: 13-Ext. VRAP, Year 2000.

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standard
DO (mg/L)	9	9	0	7.93 - 12.85	>5
DO (% sat.)	8	8	0	89.1 - 132.5	>75
pH (std. Units)	7	7	1	6.43 - 7.21	6.5-8.0
Turbidity (NTUs)	9	9	0	1.9 - 3.3	<10 NTU above background
Conductivity (μmho/cm)	9	9	0	129.5 - 157.2	NA

3.2.1.1. Dissolved Oxygen

Figure 2 shows the DO concentrations during summer 2000. The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day.

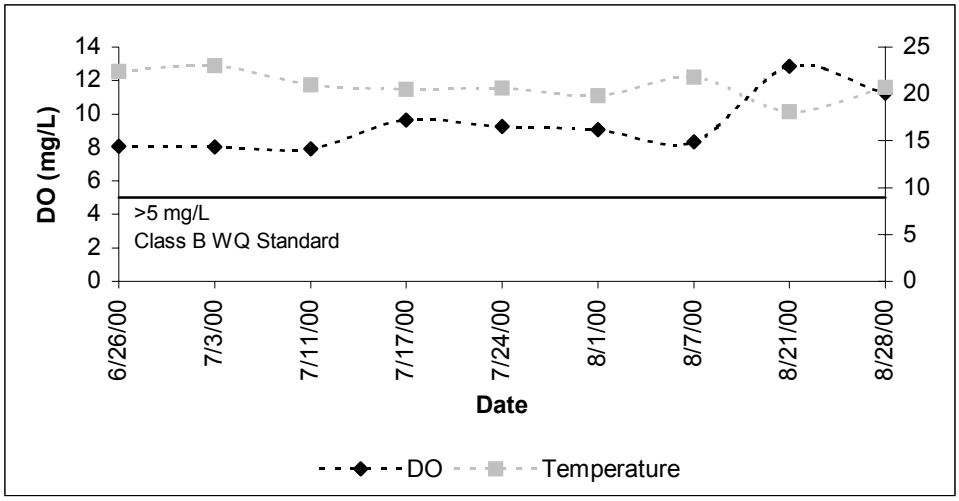


Figure 2. Dissolved Oxygen (DO) Concentration vs. Temperature. Exeter River at 13-Ext. Kinston Road Bridge, Exeter, NH. VRAP, Year 2000.

3.2.1.2. pH

The pH at this location, ranging from 6.43 to 7.21, was measured below the state standard range on one of the seven monitoring dates.

Station conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands, then the low pH measurements are not considered a violation of water quality standards. In this case, additional information about factors influencing pH levels is needed.

3.2.2. Recommendations

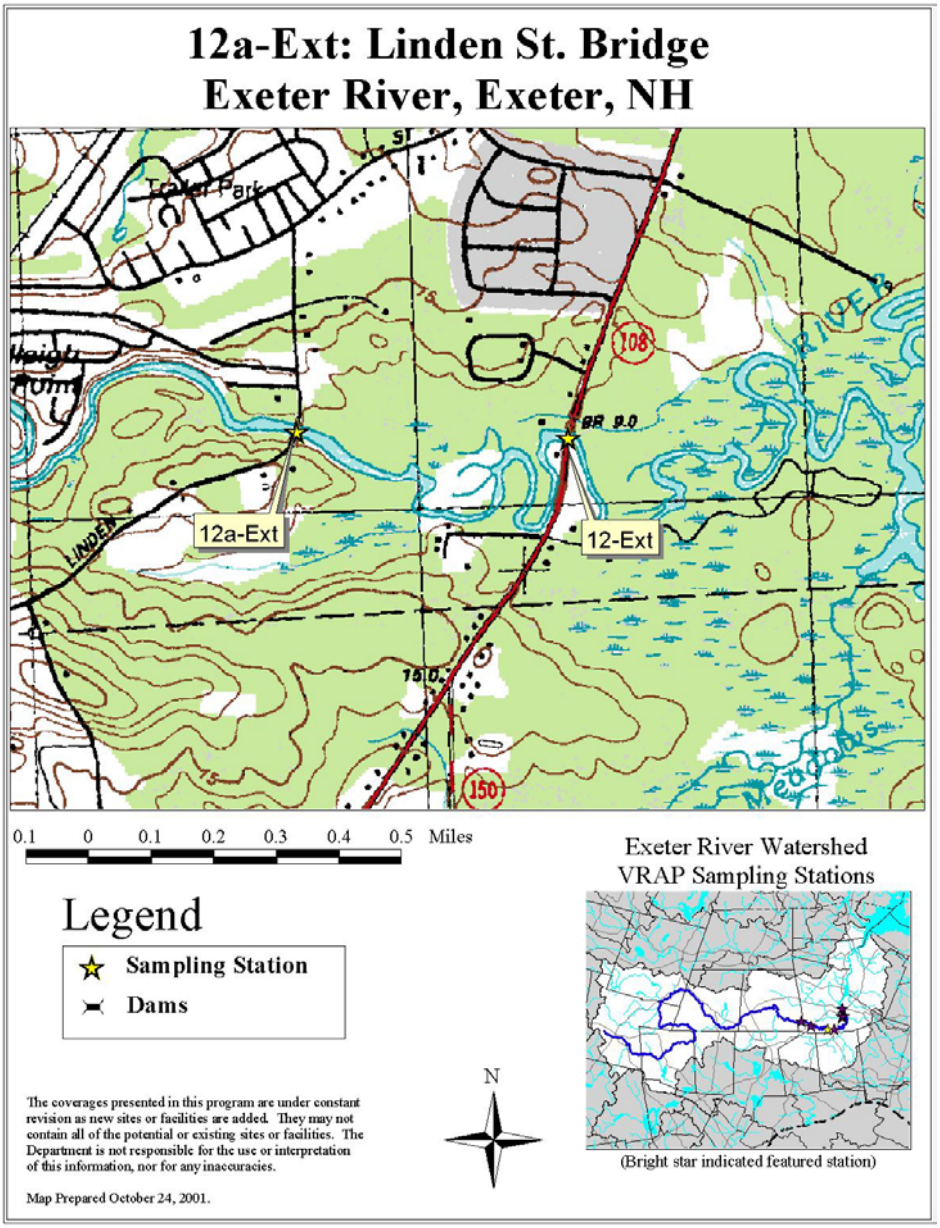
Baseline Monitoring: Volunteers are encouraged to continue baseline monitoring activities at this location to establish a record of water quality during all weather conditions. VRAP volunteers are making an increasing amount of water quality data available, in some locations for the very first time. The sampling that has taken place has helped create the recommendations in this report, and VRAP monitoring augments the data collection and river management efforts of DES as well as local decision makers. The more information in the baseline data set, the more will be known about the river's water quality dynamics, or variations.

- *Dissolved Oxygen*: Keeping a record of DO will help to document variations in the river, and provide early detection of changes in the river. Prior to volunteer monitoring efforts, little information about the river at this location was available. It is important to note that good DO levels at this location help to maintain DO levels downstream. Although the river appears to be meeting the minimum instantaneous DO concentration (5 mg/L) at this location, baseline monitoring should continue with special attention to the time of sampling.

To determine if oxygen saturation in the river at this location falls below water quality standards, monitoring data must represent worst and best-case scenarios of DO saturation. Volunteers working with DES can provide the watershed community with the necessary morning **and** afternoon data points. Arrangements for sampling oxygen saturation in the river more than once per day can be made through VRAP and the Ambient River Monitoring Program.

- *pH*: Volunteers can help determine if this location in the river meets the pH standard by providing DES with additional water quality data and information about the influences affecting water quality at this station. This process will not be completed in the short term, because of the variability of water quality and the amount of research required. Volunteers should plan to follow one of the three phases previously described each year, until a determination can be made in cooperation with DES.

3.3. 12a-Ext: Linden Street Bridge, Exeter, NH



3.3.1. Results and Discussion

Nine measurements for dissolved oxygen, turbidity, and conductivity, were made, while seven were made for pH in the field using handheld meters. All measurements and samples met the QA/QC requirements, and all data indicate that the Exeter River at 12a-Ext in the year 2000 meets Class B Water Quality Standards for the parameters evaluated (see Table 3).

Table 3. Monitoring Summary: 12a-Ext. VRAP, Year 2000.

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standard
DO (mg/L)	9	9	0	7.02 - 9.5	**>5**
DO (% sat.)	9	9	0	80.2 - 101.2	**>75**
pH (std. Units)	7	7	0	6.72 - 7.11	**6.5-8.0**
Turbidity (NTUs)	9	9	0	3 - 4.1	**<10 NTU above background**
Conductivity (μmho/cm)	9	9	0	140.9 - 156	**NA**

3.3.1.1. Dissolved Oxygen

Figure 3 shows the DO concentrations during summer 2000. Dissolved oxygen in the river at 12a-Ext remained well above the minimum required concentration of 5 mg/L (see Figure 3). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day.

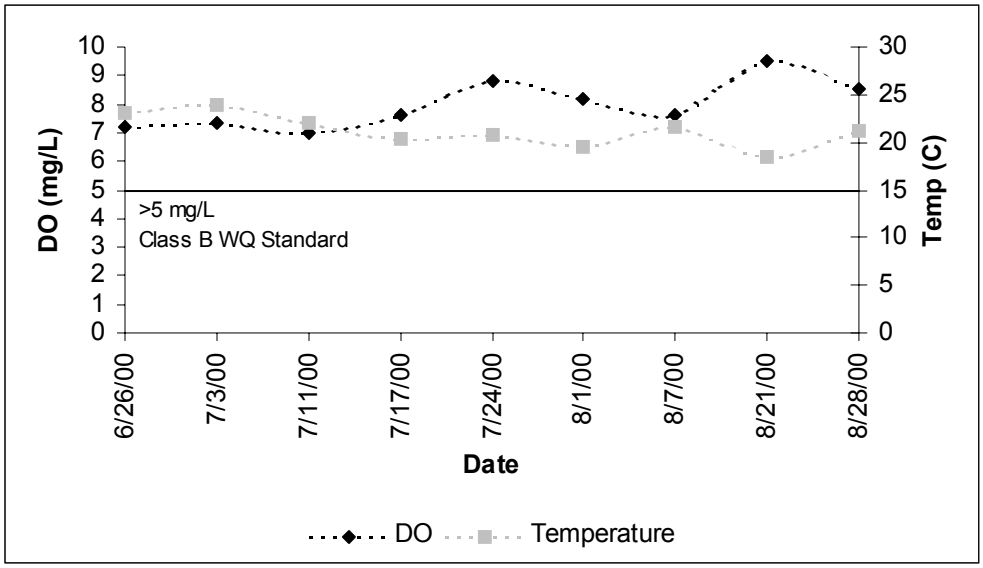


Figure 3. Dissolved Oxygen (DO) Concentration vs. Temperature. Exeter River at 12a-Ext, Linden Street Bridge, Exeter, NH. VRAP, Year 2000.

3.3.2. Recommendations

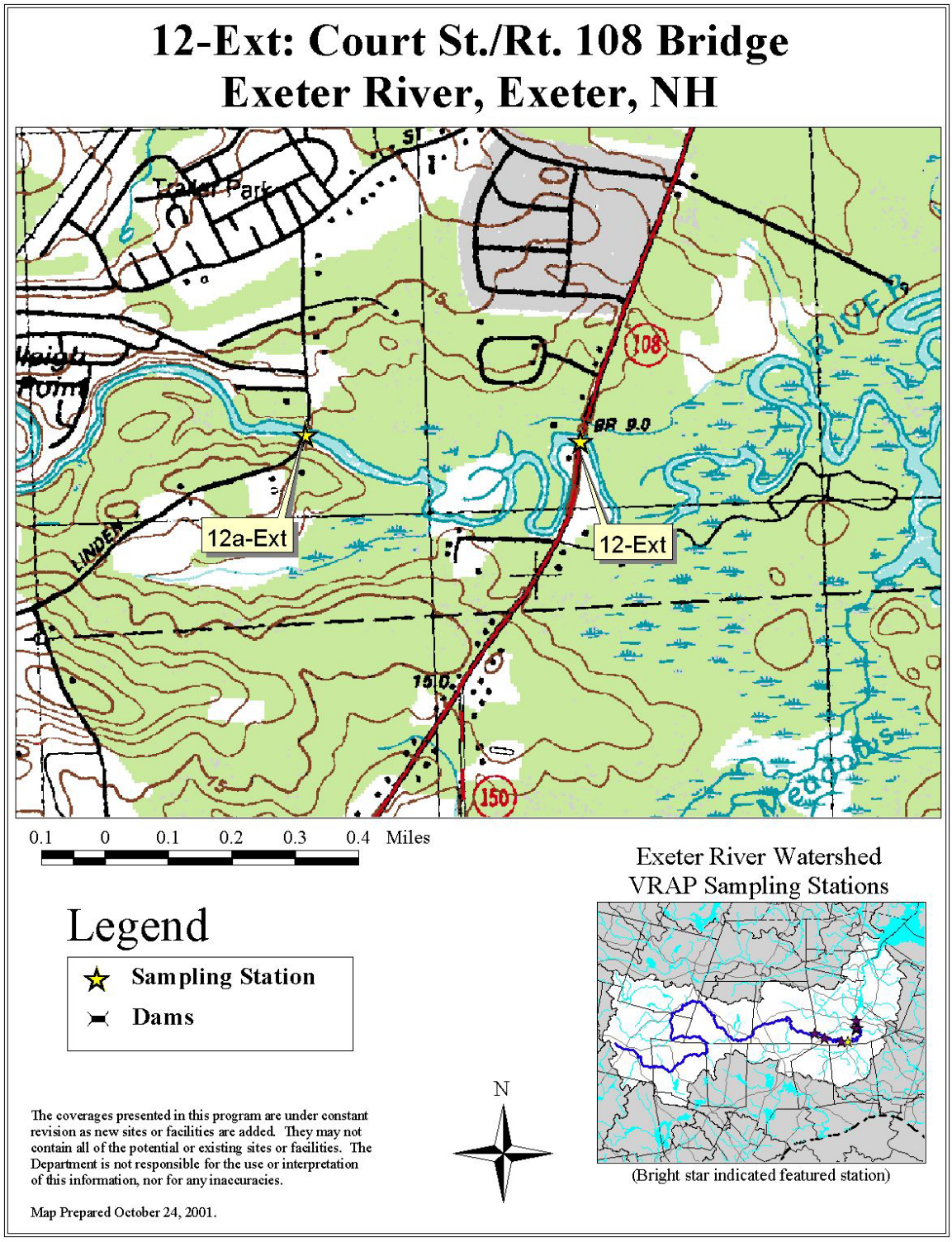
- *Baseline Monitoring*: Volunteers are encouraged to continue baseline monitoring activities at this location to establish a record of water quality during all weather conditions. VRAP volunteers are making an increasing amount of water quality data available, in some locations for the very first time. The sampling that has taken place has helped create the recommendations in this report, and VRAP monitoring augments the data collection and river management efforts of DES as well as local decision makers. The more information in the baseline data set, the more will be known about the river's water quality dynamics, or variations.

  Special attention should be paid to weather conditions previous to and during the time of sampling. For data interpretation purposes, it is extremely important that weather conditions are provided to VRAP along with the water quality data. Without a record of weather conditions, it is difficult to speculate on the cause of water quality conditions.

- *Dissolved Oxygen*: Keeping a record of DO will help to document variations in the river, and provide early detection of changes in the river. Prior to volunteer monitoring efforts, little information about the river at this location was available. It is important to note that good DO levels at this location help to maintain DO levels downstream. Although the river appears to be meeting the minimum instantaneous DO concentration (5 mg/L) at this location, baseline monitoring should continue with special attention to the time of sampling.

  To determine if oxygen saturation in the river at this location falls below water quality standards, monitoring data must represent worst and best-case scenarios of DO saturation. Volunteers working with DES can provide the watershed community with the necessary morning **and** afternoon data points. Arrangements for sampling oxygen saturation in the river more than once per day can be made through VRAP and the Ambient River Monitoring Program.

3.4. 12-Ext: Court Street Bridge, Exeter, NH



3.4.1. Results and Discussion

Nine measurements for dissolved oxygen, turbidity, and conductivity, were made, while seven were made for pH in the field using handheld meters. All measurements and samples met the QA/QC requirements, and all data indicate that the Exeter River at 12-Ext in the year 2000 meets Class B Water Quality Standards for the parameters evaluated (see Table 4).

Table 4. Monitoring Summary: 12-Ext. VRAP, Year 2000.

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standard
DO (mg/L)	9	9	0	7.03 - 9.4	>5
DO (% sat.)	9	9	0	79.4 - 100	>75
pH (std. Units)	7	7	0	6.58 - 7.17	6.5-8.0
Turbidity (NTUs)	9	9	0	3.6 - 5.5	<10 NTU above background
Conductivity (µmho/cm)	9	9	0	90.3 - 160.6	NA

3.4.1.1. Dissolved Oxygen

Figure 4 shows the DO concentrations during summer 2000. Dissolved oxygen in the river at 12-Ext remained well above the minimum required concentration of 5 mg/L (see Figure 4). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day.

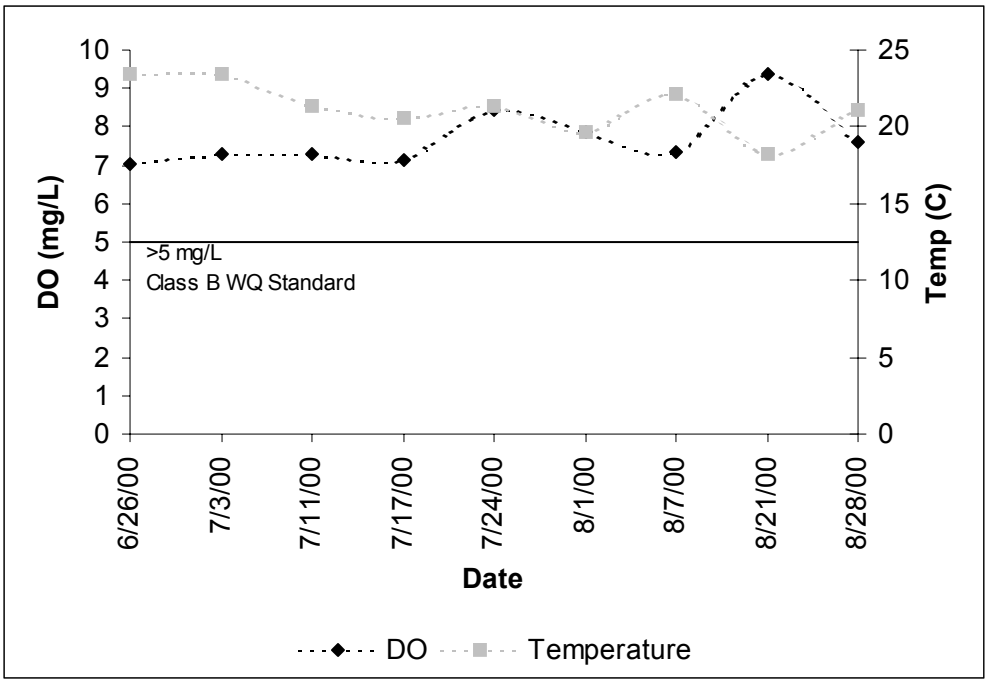


Figure 4. Dissolved Oxygen (DO) Concentration vs. Temperature. Exeter River at 12-Ext, Court Street Bridge, Exeter, NH. VRAP, Year 2000.

3.4.2. Recommendations

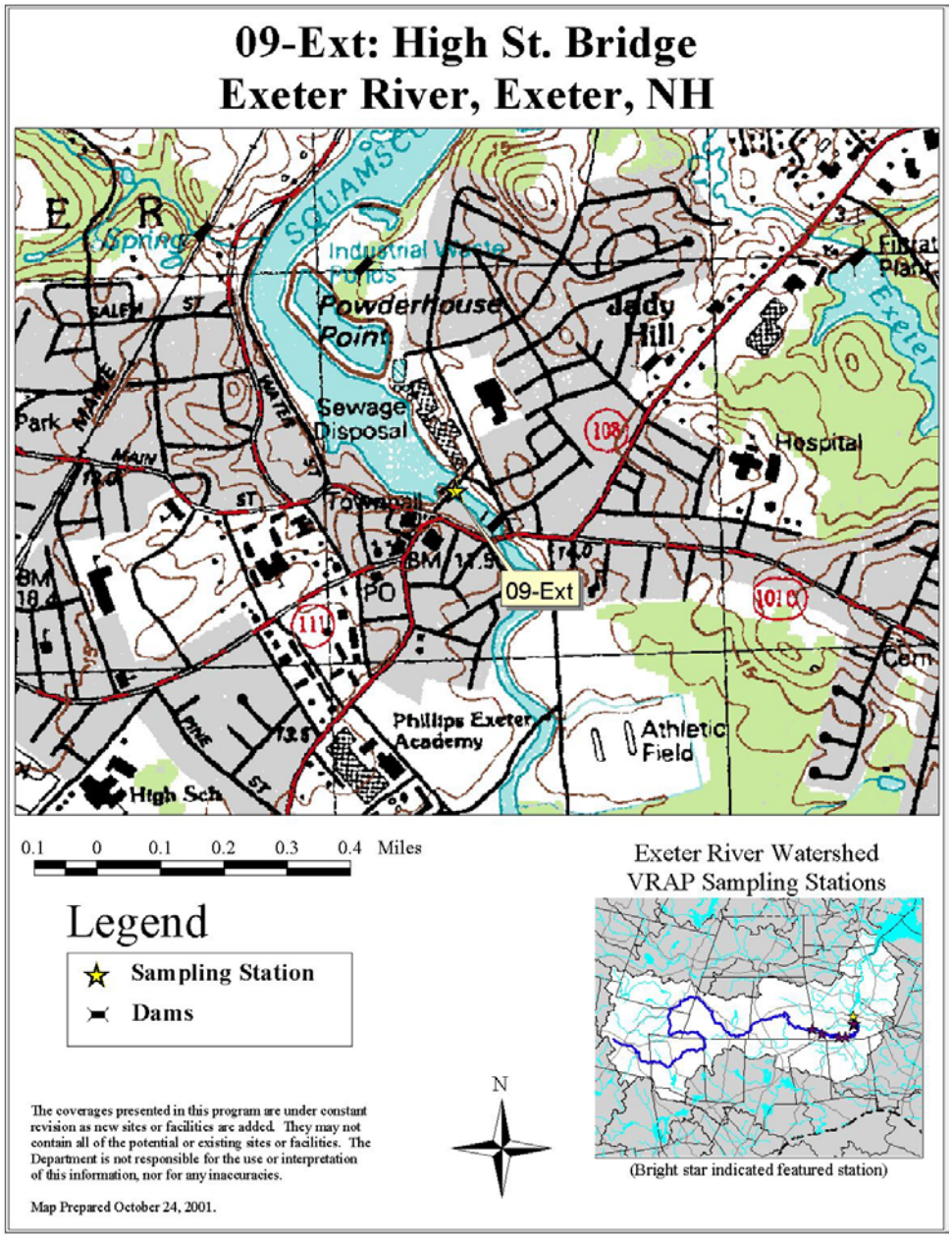
- *Baseline Monitoring*: Volunteers are encouraged to continue baseline monitoring activities at this location to establish a record of water quality during all weather conditions. VRAP volunteers are making an increasing amount of water quality data available, in some locations for the very first time. The sampling that has taken place has helped create the recommendations in this report, and VRAP monitoring augments the data collection and river management efforts of DES as well as local decision makers. The more information in the baseline data set, the more will be known about the river's water quality dynamics, or variations.

  Special attention should be paid to weather conditions previous to and during the time of sampling. For data interpretation purposes, it is extremely important that weather conditions are provided to VRAP along with the water quality data. Without a record of weather conditions, it is difficult to speculate on the cause of water quality conditions.

- *Dissolved Oxygen*: Keeping a record of DO will help to document variations in the river, and provide early detection of changes in the river. Prior to volunteer monitoring efforts, little information about the river at this location was available. It is important to note that good DO levels at this location help to maintain DO levels downstream. Although the river appears to be meeting the minimum instantaneous DO concentration (5 mg/L) at this location, baseline monitoring should continue with special attention to the time of sampling.

To determine if oxygen saturation in the river at this location falls below water quality standards, monitoring data must represent worst and best-case scenarios of DO saturation. Volunteers working with DES can provide the watershed community with the necessary morning **and** afternoon data points. Arrangements for sampling oxygen saturation in the river more than once per day can be made through VRAP and the Ambient River Monitoring Program.

3.5. 09-Ext: High Street Bridge, Exeter, NH



3.5.1. Results and Discussion

Eight measurements for dissolved oxygen, turbidity, and conductivity, were made, while six were made for pH in the field using handheld meters. All measurements and samples met the QA/QC requirements, but DO data indicate that the Exeter River at 09-Ext in the year 2000 does not meet Class B Water Quality Standards for the parameters evaluated (see Table 5).

Table 5. Monitoring Summary: 09-Ext. VRAP, Year 2000.

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards
DO (mg/L)	8	8	1	4.38 - 7.42	**>5**
DO (% sat.)	8	8	4	49.1 - 84.2	**>75**
pH (std. units)	6	6	0	6.72 - 6.98	**6.5-8.0**
Turbidity (NTUs)	8	8	0	3.8 - 4.68	**<10 NTU above backgrd**
Conductivity (μmho/cm)	8	8	0	146.2 - 165.9	**NA**

3.5.1.1. Dissolved Oxygen

Figure 5 shows the DO concentrations during summer 2000. Dissolved oxygen in the river at 09-Ext fell below the minimum required concentration of 5 mg/L (see Figure 5). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Additional sampling is necessary, as low DO saturation at this station occurred in both 1998 and 1999.

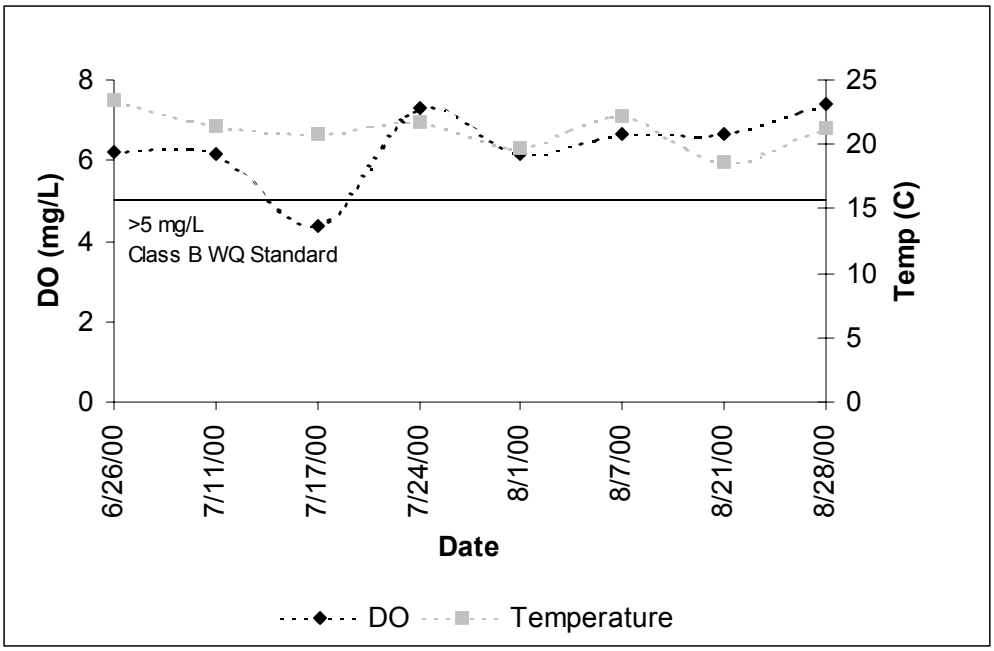


Figure 5. Dissolved Oxygen (DO) Concentration vs. Temperature. Exeter River at 09-Ext, High Street Bridge, Exeter, NH. VRAP, Year 2000.

3.5.2. Recommendations

- *Baseline Monitoring*: VRAP volunteers are making water quality data available across the State of New Hampshire, in some locations for the very first time. Prior to volunteer monitoring efforts, very little information about the river in this location was available. The volunteer sampling that has taken place has helped create the recommendations in this report. Volunteers are encouraged to continue baseline monitoring activities at this location to establish a record of water quality during all weather conditions, and to ensure that this area of the river remains within standards. The more information in the baseline data set, the more will be known about the river's water quality dynamics, or variations. Volunteer monitoring augments the data collection and river management efforts of DES, as well as local decision makers.

  Special attention should be paid to weather conditions previous to and during the time of sampling. For data interpretation purposes, it is extremely important that weather conditions are provided to VRAP along with the water quality data. Without a record of weather conditions, it is extremely difficult to speculate on the cause of water quality conditions.

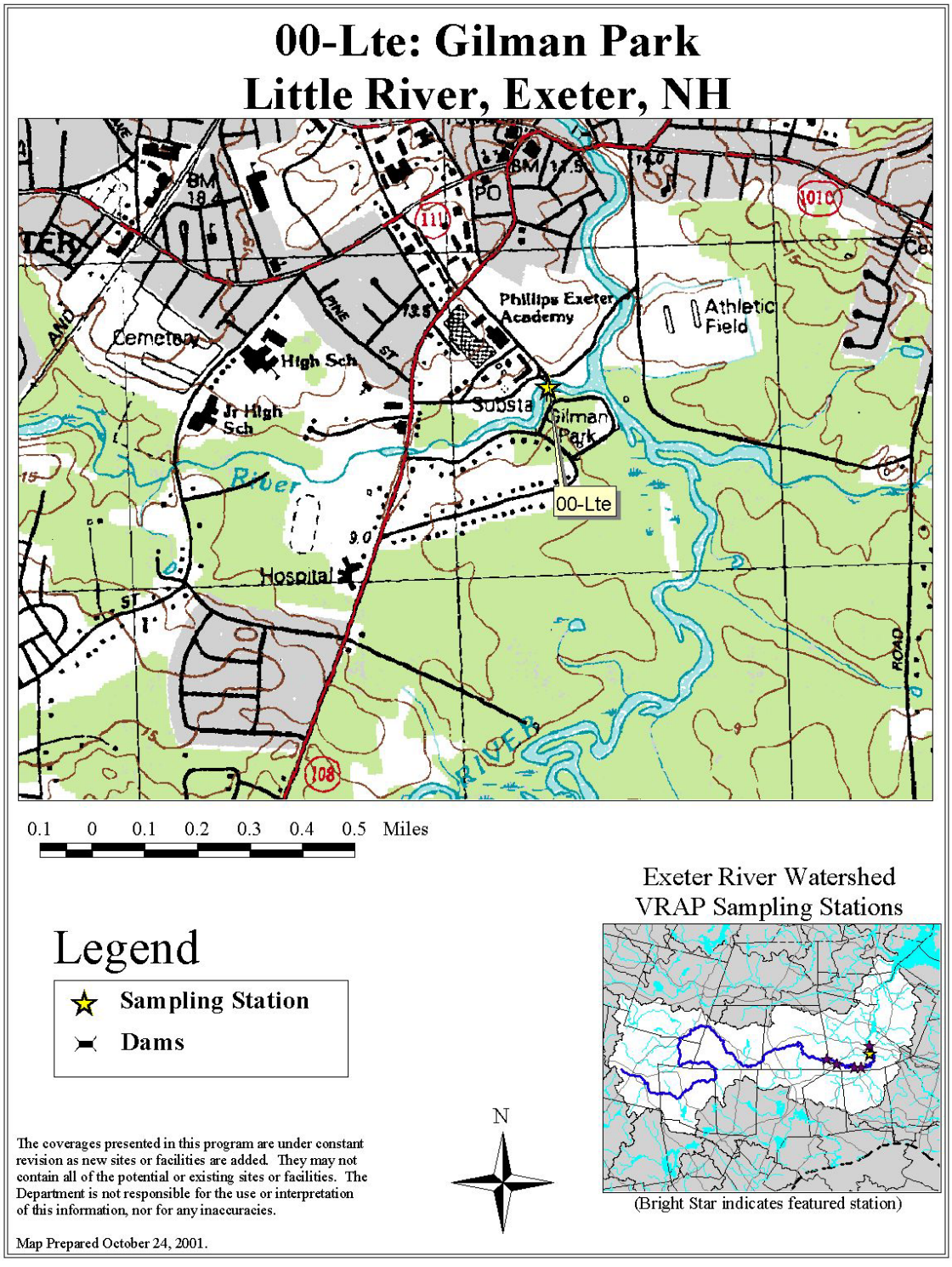
- *Dissolved Oxygen*: Keeping a record of DO will help to document variations in the river, and provide early detection of changes in the river. Prior to volunteer monitoring efforts, little information about the river at this location was available. It is important to note that good DO levels at this location help to maintain DO

levels downstream. Although the river appears to be meeting the minimum instantaneous DO concentration (5 mg/L) at this location, baseline monitoring should continue with special attention to the time of sampling.

To determine if oxygen saturation in the river at this location falls below water quality standards, monitoring data must represent worst and best-case scenarios of DO saturation. Volunteers working with DES can provide the watershed community with the necessary morning **and** afternoon data points. Arrangements for sampling oxygen saturation in the river more than once per day can be made through VRAP and the Ambient River Monitoring Program.

Volunteers are encouraged to measure the percent saturation during the early morning hours (6:00-8:00 a.m.) and the mid-late afternoon hours (3:00-5:00 p.m.) to begin investigation into DO saturation in the river. Early morning samples usually represent the lowest DO concentrations, while mid-late afternoon samples represent the highest DO concentrations in the river. These data points will provide volunteers and DES with worst and best-case scenarios of DO saturation at this location.

3.6. 00-Lte: Little River, Gilman Park, Exeter, NH



3.6.1. Results and Discussion

Nine measurements for dissolved oxygen, turbidity, and conductivity, were made, while seven were made for pH in the field using handheld meters. All measurements and samples met the QA/QC requirements, but DO data indicate that the Exeter River at 00-Lte in the year 2000 does not meet Class B Water Quality Standards for the parameters evaluated (see Table 6).

Table 6. Monitoring Summary: 00-Lte. VRAP, Year 2000.

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards
DO (mg/L)	9	9	2	4.8 - 7.13	**>5**
DO (% sat.)	9	9	8	52.8 - 86.7	**>75**
pH (std units)	7	7	0	6.66 - 6.92	**6.5-8.0**
Turbidity (NTUs)	9	9	0	3.3 - 6.2	**<10 NTU above background**
Conductivity (μmho/cm)	9	9	0	146.7 - 188.5	**NA**

3.6.1.1. Dissolved Oxygen

Figure 6 shows the DO concentrations during summer 2000. Dissolved oxygen in the river at 00-Ext fell below the minimum required concentration of 5 mg/L (see Figure 6). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day.

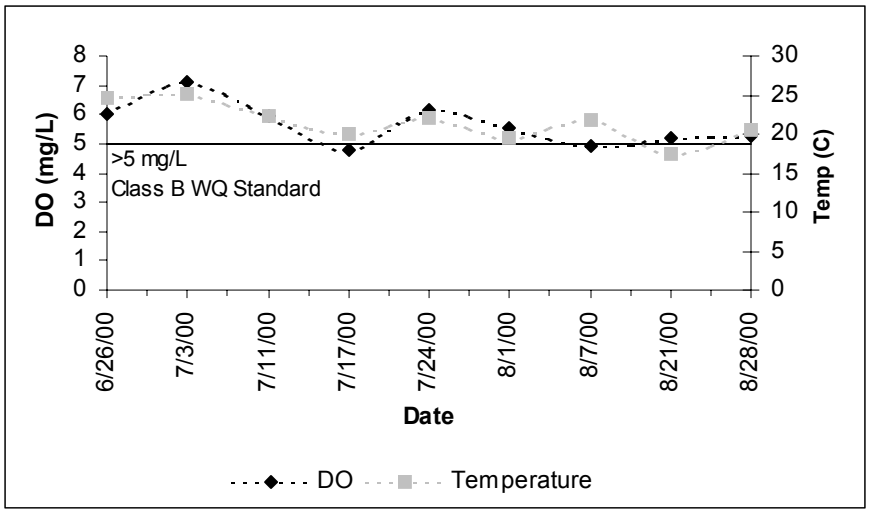


Figure 6. Dissolved Oxygen (DO) Concentration vs. Temperature. Little River at 00-Lte, Gilman Park, Exeter, NH. VRAP, Year 2000.

3.6.2. Recommendations

- *Baseline Monitoring*: VRAP volunteers are making water quality data available across the State of New Hampshire, in some locations for the very first time. Prior to volunteer monitoring efforts, very little information about the river in this location was available. The volunteer sampling that has taken place has helped create the recommendations in this report. Volunteers are encouraged to continue baseline monitoring activities at this location to establish a record of water quality during all weather conditions, and to ensure that this area of the river remains within standards. The more information in the baseline data set, the more will be known about the river's water quality dynamics, or variations. Volunteer monitoring augments the data collection and river management efforts of DES, as well as local decision makers.

  Special attention should be paid to weather conditions previous to and during the time of sampling. For data interpretation purposes, it is extremely important that weather conditions are provided to VRAP along with the water quality data. Without a record of weather conditions, it is extremely difficult to speculate on the cause of water quality conditions.

- *Dissolved Oxygen*: Sampling the saturation of DO (%) should be conducted more than once per day to determine if the oxygen levels in the river at this location are below the standard. Volunteers should measure the percent saturation during the early morning hours (6:00-8:00 a.m.) and the mid-late afternoon hours (3:00-5:00 p.m.) to begin investigation into DO saturation in the river. Early morning samples usually represent the lowest DO concentrations, while mid-late afternoon samples represent the highest DO concentrations in the river. These data points will provide volunteers and DES with worst and best-case scenarios of DO saturation at this location.

Appendix A:

List of Stations

Appendix B:

Raw Data Tables

Appendix C:

Parameters and Surface Water Quality Standards

Appendix D:

River Graphs

Appendix E:

Field Sampling Protocols

Appendix F:

List of Volunteers